1994 AQUATIC MACROINVERTEBRATE AND HABITAT SURVEY: EAST SPRING CREEK DRAINAGE, FLATHEAD COUNTY, MT

submitted to

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Introduction

The East Spring Creek drainage is one of several nonpoint source watershed improvement demonstration projects in Montana. Best Management Practices have been implemented in an attempt to reduce nonpoint source pollution in the watershed. The success of these programs will be measured, in part, by improved biotic condition in receiving streams. This approach uses changes in the biological integrity of the aquatic community to document improved water and habitat quality. To this end, surveys of aquatic macroinvertebrates and habitat in East Spring Creek and Trumbull Creek have been conducted since 1989. Samples collected prior to 1994 were analyzed and interpreted by Bukantis (1990), Wisseman (1992) and Brooks (1993). Bukantis (1990) found that, in 1989 and 1990, all sites on East Spring Creek were moderately impaired compared to Ben Hart Spring Creek, a minimally impaired spring Creek. Brooks (1993) reported that all sites in East Spring Creek and Trumbull Creek were moderately impaired in 1991, but noted a slight improvement in lower East Spring Creek and Trumbull Creek in 1992. This report presents the 1994 data and reevaluates the 1991 and 1992 data to document trends over the past four years. The objectives of this investigation were to:

1- provide a current assessment of overall biotic conditions in the study area,

2- evaluate the relative conditions in four stream reaches,

3- describe the degree and probable causes of biological impairment in these reaches,

4- compare data from 1991, 1992 and 1993, and describe any trends that indicate changing environmental condition.

Rationale

Aquatic macroinvertebrate communities consist primarily of immature insects, including stoneflies (Plecoptera), caddisflies (Trichoptera), mayflies (Ephemeroptera), true flies (Diptera), beetles (Coleoptera) and others. Evaluating the biological integrity of this assemblage can provide an assessment of environmental quality and can be used to identify limiting factors, for detecting impacts from physical alterations, sediment deposition, nutrients and toxicants, and to document successful mitigation of environmental degradation. Biological integrity has been defined as "the capability of supporting and maintaining a balanced, integrated, adaptive community having species composition, diversity and functional organization comparable to that of natural habitat of the region" (Karr and Dudley 1981). Macroinvertebrates are important components of aquatic ecosystems, and are the energy link between primary producers (algae), organic inputs to the stream, and fish. They are good indicators of environmental conditions due to their limited mobility, predictable associations with specific habitats, and differential tolerances to pollution.

Methods

Field work was conducted by Montana Water Quality Division (WQD) personnel. The first set of samples and habitat data were collected in November, 1989. Subsequent field work was conducted during August of 1990, 1991, and 1992. The most recent survey was completed on August 31, 1994. Stream habitat was rated and aquatic macroinvertebrates were collected at three locations in East Spring Creek (ESC) and at one site on Trumbull Creek. From downstream to upstream, collection sites were designated as: ESC at Highway 35, ESC at Granite View, Trumbull Creek at mouth, and ESC below Farrier's Dam. Macroinvertebrates were collected from riffles using standard traveling kick-net methods and habitat parameters were scored using a modified version of the U.S. EPA Rapid Bioassessment Protocols (RBP) habitat assessment field data sheet. In 1994, two samples were obtained from each reach except ESC at Granite View where a single sample was collected.

Laboratory and data analyses were contracted to McGuire Consulting. Techniques described in the Montana RBP guidelines (Bukantis 1995) were used for both habitat and biological assessments.

Macroinvertebrate samples

The 1994 macroinvertebrate samples were sorted using RBP III techniques (Plafkin et al. 1989) to provide approximately 300 organism subsamples. Organisms were enumerated and identified to the taxonomic level specified by the WQD (Bukantis 1995), usually genus or species. Tolerance values and functional designations used in metric calculations were those provided by Bukantis (1995).

The RBP assessment provided numerical estimates of biological integrity. Assessments incorporated nine metrics: Taxa richness, EPT richness (Ephemeroptera, Plecoptera and Trichoptera), Biotic index, % dominant taxon, % Collectors, % Scrapers and Shredders, % Hydropsychinae of Trichoptera, % EPT, and the Community Tolerance Quotient (CTQa). Metric values were compared to reference values and assigned scores ranging from 0 (severely impaired) to 6 (nonimpaired). Reference values used to evaluate these data represent the best (highest or lowest) value of each metric from the 12 reach assessments (mean values used when replicated) available for East Spring and Trumbull creeks. Scoring criteria for this assessment (Table 3) were based on percent comparability to the reference value (adapted from McGuire 1994). The combined score of all metrics was expressed as a percentage of the maximum possible score and used as an estimate of biological integrity. Impairment classifications (Table 4) for both assessments were from Plafkin et al. (1989).

This assessment provides a discriminating evaluation of relative conditions within the study area. Data from 1991 and 1992 were recalculated to standardize metrics among years. Two samples from ESC at Highway 35 collected in 1992 were combined to provide data closer to the 300 organism standard. Biological data from 1989 and 1990 were not included due to unreconcilable differences in sample size, levels of taxonomy, and season of collection.

Habitat data

At most sites, habitat was evaluated on five dates from 1989 through 1994 (Table 1). Only the nine metrics common to all years were used to evaluate temporal trends. Impairment classifications and graphic representations were expressed as a percentage of the maximum (135) possible score. Total scores for all parameters evaluated each year were calculated and were also presented as a percentage of the maximum possible score.

Results and Discussion

Habitat Assessment

From 1989 to 1994, habitat was classified as optimal or sub-optimal at all study sites (Tables 1 and 2). Mean habitat scores for individual sites ranged from 79% in lower Trumbull Creek to 90% in the Granite View reach of East Spring Creek and indicated optimal to near optimal conditions. For the entire study area, a slight improvement in habitat quality was indicated from 1990 through 1992. Over six years of monitoring (1989 through 1994 - with no data for 1993), habitat scores (all sites combined) were, respectively, 77, 73, 84, 88 and 81%. Habitat classifications were based on the combined score of nine instream, bank, and riparian parameters common to all years. Graphic comparisons (Figure 1) depict percentages of the maximum possible score for nine metrics. Additional parameters evaluated since 1991 lowered overall habitat scores in all cases (Table 1).

Habitat scores for the lower reach of East Spring Creek (Highway 35) ranged from 73 to 87% and averaged 81%. Habitat was sub-optimal or optimal on all dates and no trend in habitat condition was evident (Figure 1). The highest habitat score was recorded in 1992 while the lowest score was in 1994. All six instream habitat parameters received lower scores in 1994 than in 1992 (Table 1) with increased substrate embeddedness as the greatest discrepancy between years.

Habitat was considered optimal in the middle reach of East Spring Creek (Granite View) on all dates sampled (Table 1). Habitat scores ranged from 84 to 95% and averaged 90%.

Habitat condition improved slightly over time in the upstream reach (below Farrier's Dam) of East Spring Creek (Figure 1). Habitat was classified as sub-optimal during the first two years of monitoring but, since 1991, has been classified as optimal. Improved habitat condition was primarily attributable to reduced channel alteration, increased riffle frequency and more stable instream substrates.

Habitat in lower Trumbull Creek was sub-optimal to optimal throughout the study. Habitat scores ranged from 74 to 84% and averaged 79% (Table 2). Habitat was classified as optimal in 1991 and 1992, but was sub-optimal in 1994 due to slight reductions in the scores of most instream and channel parameters.

Macroinvertebrate Assessment

Macroinvertebrate identifications, enumerations, and metric values for the 1991, 1992 and 1994 samples are presented in Appendix A.

Reference values drawn from the East Spring Creek data provided a realistic baseline (Table 3) for evaluating conditions in the stream. The internally derived reference provided a sensitive assessment of relative biological conditions among stream reaches. Data from 1991, 1992, and 1994 were evaluated.

During all three years, biological integrity was lowest in the upstream reach and improved with distance downstream (Figure 2). Based on average scores for the past three years of monitoring, biological integrity was moderately impaired in the Farrier's Dam (upper) reach and slightly impaired in Trumbull Creek and the two downstream reaches of East Spring Creek. Since 1991, biointegrity scores averaged 36, 59 and 61%, respectively, in the upper, middle and lower reaches of East Spring Creek. Trumbull Creek had a mean biointegrity score of 53% over the same time frame.

At all sites, biological impairment was indicated by relatively low EPT richness and abundance, high biotic index and Community Tolerance (CTQa) values, and skewed distributions of individuals among functional feeding groups (Table 5). The benthic community was typically dominated by chironomids, blackflies, tolerant caddisflies (*Cheumatopsyche*) and non-insects. In particular, the absence of stoneflies, and the low number of mayfly taxa were signs of limited biological integrity. The relatively high biotic index values

(range 3.8 to 5.9) indicated organic enrichment as a limiting factor, especially in the upstream reach.

Biointegrity has improved, at least slightly, at all four stations since 1991. For all stations combined, mean biological integrity increased from 37% in 1991 to 60% in 1992 and 1994. During the past three years of monitoring, biointegrity estimates for individual sites ranged from 30 to 78% (Table 5). Increased biointegrity estimates were due to slight improvements in all metrics. Since habitat quality was at or near optimal conditions, improved water quality appeared to be the principle factor enhancing biological integrity in the study area.

Improvement was most evident in the Granite View and Highway 35 reaches (Figure 2). In the Highway 35 reach, biological integrity was moderately impaired in 1991 (30%) but only slightly impaired in 1992 (74%) and 1994 (78%). The biointegrity estimate for 1994 was the highest recorded in the study area. Compared with 1991, all metrics improved in 1992 and 1994 (Table 5). An increase in the number of caddisfly taxa over time was a clear sign of improved environmental quality in this reach.

The Granite View reach of East Spring Creek showed a similar improvement between 1991 (41%) to 1992 (70%). Biointegrity was estimated at 67% in 1994. As in the lower reach, all metrics indicated improving conditions since 1991 (Table 5).

Biological integrity remained moderately impaired in the Farrier's Dam reach throughout the monitoring period (Figure 2). Biointegrity estimates ranged from 30 to 41%. Although taxa richness increased over time, no other metrics showed a consistent improvement (Table 5). Unlike downstream reaches, the benthic community in this reach was dominated by *Cheumatopsyche* caddisflies. These filter-feeding organisms are fairly tolerant of organic pollution, sedimentation and high water temperatures. The thermal regime may be a natural condition limiting the benthic community at this site.

Biointegrity in lower Trumbull Creek improved from 1991 (48%) to 1992 (56%). This improvement was maintained in 1994. The slight increase in biological integrity was due to higher taxa richness and a shift in the caddisfly assemblage.

Table 1. Stream and riparian habitat assessments for East Spring Creek.

Stream: East Spring Creek, Flathead County, MT

Location:	Hwy 35					Granite view			Farriers Dam				
Date:	1989	1990	1991	1992	1994	1991	1992	1994	1989	1990	1991	1992	1994
Parameter													
P substrate	18	18	20	20	17	20	20	19	18	20	20	20	19
P embeddedness	13	19	20	20	13	18	20	20	18	19	20	20	20
P discharge/vel&depth	18	14	15	18	16	10	18	18	11	12	11	12	10
P canopy cover			18	14		12	18				15	15	
S channel alteration	14	10	12	10	8	12	14	15	13	6	15	15	15
S substrate stability	14	9	14	13	11	15	14	14	13	6	14	15	15
S pool/riffle	10	10	8	12	6	9	12	8	5	5	8	9	7
S flow status					15			15					15
T bank stability	9	7	10	8	10	10	10	9	9	10	9	10	10
T bank cover stability	9	9	10	9	9	10	10	10	9	10	10	10	10
T streamside cover	7	6	5	7	9	10	10	10	5	5	5	5	10
T riparian width			1	2	2	5	5	5			5	4	6
9 parameters (135 max)													
total score	112	102	114	117	99	114	128	123	101	93	112	116	116
% score	83%	76%	84%	87%	73%	84%	95%	91%	75%	69%	83%	86%	86%
Classification	Opt	Sub	Opt	Opt	Sub	Opt	Opt	Opt	Sub	Sub	Opt	Opt	Opt
all parameters													
total score	112	102	133	133	116	131	151	143	101	93	132	135	137
% score	83%	58%	81%	81%	64%	79%	92%	79%	75%	53%	80%	82%	76%
	Opt	Sub	Opt	Opt	Sub	Opt	Opt	Opt	Sub	Sub	Opt	Opt	Sub

Categories (9 parameters): Optimal >110, Sub-optimal 102-75, Marginal 66 - 39, Poor <31.
(% of total): Optimal >81%, Sub-optimal 75-56%, Marginal 49 -29%, Poor <23%.

Table 2. Stream and riparian habitat assessments fro Trumbull Creek.

Stream:	Trumbull Creek, Flathead County, MT			
Location:	near mouth			
Date:	1989	1991	1992	1994
Parameter				
P substrate	16	20	18	16
P embeddedness	17	17	17	14
P discharge/vel&depth	14	17	17	12
P canopy cover		5	5	
S channel alteration	14	12	14	15
S substrate stability	13	13	14	8
S riffle frequency	9	11	11	8
S flow status				12
T bank stability	4	8	7	10
T bank cover stability	7	10	9	10
T streamside cover	6	5	5	8
T riparian width		1	1	1
9 parameters (135 max)				
total score	100	113	112	101
% score	74%	84%	83%	75%
Classification	Sub	Opt	Opt	Sub

Categories (9 parameters): Optimal >110, Sub-optimal 102-75, Marginal 66 - 39, Poor <31.
(% of total): Optimal >81%, Sub-optimal 75-56%, Marginal 49 -29%, Poor <23%.

Table 3. Internal reference values for East Spring and Trumbull creeks and criteria for assigning scores to metrics based on percent comparability to reference values (adapted from McGuire 1994).

metric	E.Spr. Cr. Reference	Scoring Criteria 6	4	2	0	*
Taxa richness	28	>80%	80-60%	60-40%	<40%	a
EPT richness	8	>85%	85-70%	70-50%	<50%	a
Biotic index	3.8	>90%	90-80%	80-70%	<70%	b
% dominant taxon	23	>60%	60-45%	45-30%	<30%	b
% Collector-FFG	71	>90%	90-80%	80-70%	<70%	b
% Scraper+Shredder	22	>80%	80-60%	60-40%	<40%	a
% Hydro. of Trich		<75	75-85	85-95	>95	c
% EPT	70	>75%	75-50%	50-25%	<25%	a
CTOa	59	>90%	90-80%	80-70%	<70%	b

Internal reference values are the "best" values among Ninemile Creek samples.
* a = score is ratio of study site to reference X 100.
* b = score is ratio of reference to study site X 100.
* c = based on actual value, not a percentage of reference.

Table 4. Criteria for the assessment of biologically significant environmental degradation (Plafkin et al 1989).

% comp. to reference	Classification
>83%	nonimpaired
54-79%	slightly impaired
21-50%	moderately impaired
<17%	severely impaired

Table 5. Metric values, percentage of reference, and bioassessments for East Spring and Trumbull creeks, during August, 1991, 1992 and 1994 (composite internal reference- Table 3).

location:	HWY 35			Granite View			Trumbull Creek			Farriers		
metric year:	91	92	94	91	92	94	91	92	94	91	92	94
Taxa richness	16	19	28	17	22	24	21	23	25	14	22	21
EPT richness	3	3	8	4	8	5	5	5	5	4	6	5
Biotic index	5.2	4.0	4.5	4.7	3.8	5.0	4.5	4.7	4.8	5.7	5.1	5.9
% dominant taxon	56	30	25	40	33	23	27	26	25	59	59	38
% Collector-FFG	94	71	83	96	94	83	94	96	85	99	92	95
% Scrapers + Shredders	4	22	14	2	2	12	5	3	6	1	3	3
% Hydropsychinae of Trich.	25	0	3	84	72	9	58	14	0	100	97	100
% EPT	4	8	12	9	28	24	4	12	15	64	70	46
CTQa	104	94	96	105	97	96	104	101	100	107	102	103
% of reference												
Taxa richness	57	68	100	71	79	86	75	82	89	50	79	75
EPT richness	38	38	100	50	100	63	63	63	63	50	75	63
Biotic index	73	95	84	81	100	76	84	81	79	67	75	64
% dominant taxon	41	77	92	58	70	100	85	88	92	39	39	61
% Collector-FFG	75	100	86	74	76	86	76	74	84	72	77	75
% Scrapers + Shredders	18	100	64	9	9	55	23	14	27	5	14	14
% Hydropsychinae of Trich.	25	0	3	84	72	9	58	14	0	100	97	100
% EPT	6	11	17	13	40	34	6	17	21	91	100	66
CTQa	90	100	98	90	97	98	90	93	94	88	92	91
metric score												
Taxa richness	2	4	6	4	4	6	4	6	6	2	4	4
EPT richness	0	0	6	2	6	2	2	2	2	2	4	2
Biotic index	2	6	4	4	6	2	4	4	2	0	2	0
% dominant taxon	2	6	6	4	6	6	6	6	6	2	2	6
% Collector-FFG	2	6	4	2	2	4	2	2	4	2	2	2
% Scrapers + Shredders	0	6	4	0	0	2	0	0	0	0	0	0
% Hydropsychinae of Trich.	6	6	6	4	6	6	6	6	6	0	0	0
% EPT	0	0	0	0	2	2	0	0	0	6	4	4
CTQa	2	6	6	2	6	6	2	4	4	2	4	2
total score	16	40	42	22	38	36	26	30	30	16	22	20
% of reference	30%	74%	78%	41%	70%	67%	48%	56%	56%	30%	41%	37%
classification	MOD	SLI	SLI	MOD	SLI	SLI	MOD	SLI	SLI	MOD	MOD	MOD

Figure 1. Habitat scores (%) for lower Trumbull Creek and three reaches of East Spring Creek, 1989 - 1994 (nine metrics).

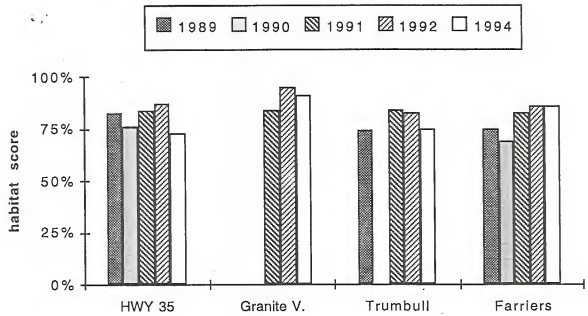
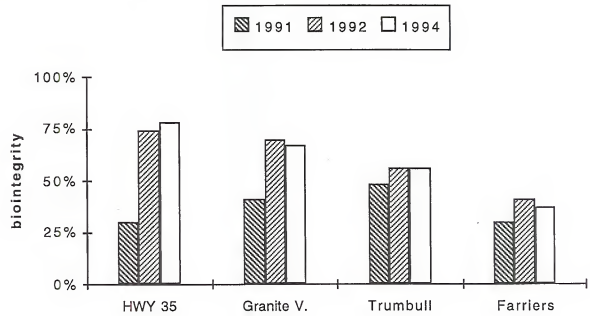


Figure 2. Biological integrity (% of reference) in lower Trumbull Creek and three reaches of East Spring Creek, 1991 - 1994



Conclusions

1. Biological integrity has improved in East Spring Creek since 1991. For all sites combined, mean biointegrity increased from 37% in 1991 to 60% in 1992 and 1994.

2. The greatest improvement occurred in the middle and lower stream reaches. In the Highway 35 reach, biological integrity was moderately impaired in 1991 (30%) but only slightly impaired in 1992 (74%) and 1994 (78%). The biointegrity estimate for 1994 was the highest recorded in the study area.

3. A similar improvement was documented in the Granite View reach. Biololgical integrity was estimated at 41, 70, and 67% repectively, in 1991, 1992 and 1993.

4. Biological integrity was moderately impaired in the Farrier's Dam reach throughout the monitoring period. Biointegrity estimates ranged from 30 to 41%. The assemblage of organisms inhabiting this reach were tolerant of organic pollution, fine sediments and relatively high water temperatures. The thermal regime at this site may be a natural limiting factor.

5. Biointegrity in lower Trumbull Creek improved slightly from 1991 (48%) to 1992 (56%). This improvement was maintained in 1994.

6. Although impacts have diminished over the past five years, biological integrity remained slightly to moderately impaired all sites in 1994. Poor water quality and, at least in the upstream reach, the thermal regime appeared to limit the biological community. Organic pollution was indicated by the predominance of tolerant macroinvertebrates and by the structure and composition of the benthic community.

6. Physical habitat did not appear to limit the biological integrity of the benthic communities in East Spring or Trumbull creeks. From 1989 to 1994, habitat was classified as optimal or sub-optimal at all study sites. Habitat quality appeared to improve slightly in the upstream reach during the monitoring period. No other temporal trends in habitat condition were evident.

7. East Spring Creek appeared to be degraded by nonpoint source pollution. The improved biological integrity in the middle and lower stream reaches were probably attributable to improved water quality since habitat quality did not change significantly and was relatively good throughout the monitoring period. These results suggest that nonpoint source pollution greatly suppressed biological integrity in East Spring Creek prior to 1992. Improved land use practices and the establishment of an effective riparian buffer appears to have significantly reduced nonpoint source pollution. However, East Spring Creek and Trumbull Creek remain degraded and biological integrity remained slightly to moderately impaired in 1994.

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APPENDIX A:

EAST SPRING CREEK and TRUMBULL CREEK

AQUATIC MACROINVERTEBRATE DATA

August, 1991, 1992 and 1994

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
East Spring Creek - HWY 35 bridge - Aug 31, 1994

sample:	1.1		1.2		Cum
Taxon	#	% RA		% RA	% RA
COLEOPTERA					
Cleptelmis ornata	8	2.6%	36	13.6%	7.6%
Optioservus spp.	9	2.9%	14	5.3%	4.0%
Zaitzevia parvula	5	1.6%	1	0.4%	1.0%
Brychius sp.	43	13.8%	4	1.5%	8.2%
DIPTERA					
Pagastia sp.	45	14.4%	41	15.5%	14.9%
Corynoneura sp.	0	0.0%	1	0.4%	0.2%
Cricotopus sp.	43	13.8%	10	3.8%	9.2%
Eukiefferiella spp.	0	0.0%	2	0.8%	0.3%
Nanocladius sp.	4	1.3%	0	0.0%	0.7%
Orthocladius sp.	0	0.0%	1	0.4%	0.2%
Parametriocnemus sp.	0	0.0%	1	0.4%	0.2%
Heterotrissocladius sp.	1	0.3%	0	0.0%	0.2%
Rheocricotopus sp.	11	3.5%	0	0.0%	1.9%
Tvetenia sp.	2	0.6%	0	0.0%	0.3%
Dicrotendipes sp.	1	0.3%	4	1.5%	0.9%
Micropsectra sp.	87	27.9%	15	5.7%	17.7%
Tanytarsus sp.	2	0.6%	0	0.0%	0.3%
Dicranota sp.	2	0.6%	0	0.0%	0.3%
Pericoma sp.	1	0.3%	3	1.1%	0.7%
Stratiomyildae	0	0.0%	2	0.8%	0.3%
Simulium spp. (Psilozoa)	9	2.9%	60	22.7%	12.0%
EPHEMEROPTERA					
Baetis tricaudatus	9	2.9%	25	9.5%	5.9%
Diphetor hageni	1	0.3%	2	0.8%	0.5%
TRICHOPTERA					
Cheumatopsyche spp.	1	0.3%	0	0.0%	0.2%
Parapsyche sp.	0	0.0%	1	0.4%	0.2%
Oxethira ? .	1	0.3%	0	0.0%	0.2%
Hydroptila sp.	3	1.0%	0	0.0%	0.5%
Psycoglypha sp.	0	0.0%	3	1.1%	0.5%
Glossosoma sp.	8	2.6%	0	0.0%	1.4%
Lepidostoma sp.	2	0.6%	5	1.9%	1.2%
Brachycentrus occidentalis	0	0.0%	1	0.4%	0.2%
Rhyacophila brunnea gp.	0	0.0%	3	1.1%	0.5%
Rhyacophila lieftincki gp.	2	0.6%	3	1.1%	0.9%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
East Spring Creek - HWY 35 bridge - Aug 31, 1994

sample:	1.1		1.2		Cum
Taxon	#	% RA		% RA	% RA
ANNELIDA					
Lumbricidae	2	0.6%	3	1.1%	0.9%
MOLLUSCA					
Lymnaeidae	5	1.6%	11	4.2%	2.8%
Physidae	1	0.3%	3	1.1%	0.7%
CRUSTACEA					
Caecidotea sp.	4	1.3%	5	1.9%	1.6%
OTHER					
Turbellaria	0	0.0%	4	1.5%	0.7%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
East Spring Creek - HWY 35 bridge - Aug 31, 1994

sample:	1.1		1.2		Cum
Taxon	#	% RA		% RA	% RA
% of sample used:	17%		50%		Mean
TOTAL ORGANISMS	312		264		288
TAXA RICHNESS	28		28		28.0
EPT RICHNESS	8		8		8.0
BIOTIC INDEX	4.35		4.73		4.54
% DOMINANT TAXON	28%		23%		25%
% EPT	9%		16%		12%
% COLLECTORS (g+f)	79%		88%		83%
% SCRAPERS + SHREDDERS	19%		9%		14%
% Hydropsychinae of TRICH	6%		0%		3%
METALS TOLERANCE INDEX	4.75		5.43		5.09
% Baetidae of EPHEM.	100%		100%		100%
SHANNON DIVERSITY	3.47		3.72		3.60
EPT/(EPT + Chironomidae)	0.12		0.36		0.24
HBI- CTQa	95		97		96
% COLEOPTERA	21%		21%		21%
% DIPTERA	67%		53%		60%
% CHIRONOMIDAE	63%		28%		46%
% EPHEMEROPTERA	3%		10%		7%
% PLECOPTERA	0%		0%		0%
% TRICHOPTERA	5%		6%		6%
% multivoltine	70%		63%		67%
% univoltine	29%		36%		32%
% semivoltine	1%		2%		1%
FFG	% RA	# taxa	% RA	# taxa	%RA
% FILTERERS	4%	3	23%	3	14%
% COLLECTOR-GATHERERS	76%	17	64%	18	70%
% SHREDDERS	15%	3	3%	2	9%
% SCRAPERS	4%	3	5%	2	5%
% PREDATORS	1%	2	4%	3	3%
Scraper/(Scraper+Filterer)	54%		18%		36%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsample
East Spring Creek - @ Granite View - Aug 31, 1994
Id's by D McGuire

sample:	2	
Taxon	#	% RA
COLEOPTERA		
Cleptelmis ornata	9	3.0%
Optioservus spp.	43	14.2%
Zaitzevia parvula	3	1.0%
Haliplus sp.	1	0.3%
Brychius sp.	3	1.0%
DIPTERA		
Pagastia sp.	17	5.6%
Cricotopus sp.	16	5.3%
Eukiefferiella spp.	7	2.3%
Orthocladius sp.	2	0.7%
Rheocricotopus sp.	1	0.3%
Tvetenia sp.	1	0.3%
Micropsectra sp.	6	2.0%
Stratiomyiidae	1	0.3%
Simulium spp.	69	22.8%
EPHEMEROPTERA		
Baetis tricaudatus	41	13.5%
Diphetor hageni	22	7.3%
TRICHOPTERA		
Cheumatopsyche spp.	1	0.3%
Parapsyche sp.	1	0.3%
Lepidostoma sp.	9	3.0%
ANNELIDA		
Lumbricidae	7	2.3%
MOLLUSCA		
Lymnaeidae	19	6.3%
Physidae	3	1.0%
CRUSTACEA		
Caecidotea sp.	6	2.0%
OTHER		
Turbellaria	15	5.0%
% of sample used:	25%	

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsample
East Spring Creek - @ Granite View - Aug 31, 1994
Id's by D McGuire

sample:	2	
Taxon	#	% RA
TOTAL ORGANISMS	303	
TAXA RICHNESS	24	
EPT RICHNESS	5	
BIOTIC INDEX	4.99	
% DOMINANT TAXON	23%	
% EPT	24%	
% COLLECTORS (g+f)	83%	
% SCRAPERS + SHREDDERS	12%	
% Hydropsychinae of TRICH	9%	
METALS TOLERANCE INDEX	4.92	
% Baetidae of EPHEM.	100%	
SHANNON DIVERSITY	3.66	
EPT/(EPT + Chironomidae)	0.60	
HBI- CTQa	96	
% COLEOPTERA	19%	
% DIPTERA	40%	
% CHIRONOMIDAE	17%	
% EPHEMEROPTERA	21%	
% PLECOPTERA	0%	
% TRICHOPTERA	4%	
% multivoltine	65%	
% univoltine	35%	
% semivoltine	0%	
FFG	% RA	# taxa
% FILTERERS	23%	
% COLLECTOR-GATHERERS	60%	
% SHREDDERS	4%	
% SCRAPERS	7%	
% PREDATORS	5%	
Scraper/(Scraper+Filterer)	24%	

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
East Spring Creek - below Farriers Dam - Aug 31, 1994
Id's by D McGuire

sample:	4.1		4.2		Cum
Taxon	#	% RA		% RA	% RA
COLEOPTERA					
Cleptelmis ornata	1	0.3%	0	0.0%	0.2%
Optioservus spp.	2	0.7%	3	1.0%	0.8%
Zaitzevia parvula	9	3.0%	11	3.6%	3.3%
DIPTERA					
Thienemannimyia gp.	6	2.0%	3	1.0%	1.5%
Corynoneura sp.	1	0.3%	1	0.3%	0.3%
Cricotopus sp.	22	7.2%	3	1.0%	4.1%
Orthocladius sp.	1	0.3%	0	0.0%	0.2%
Microtendipes sp.	1	0.3%	0	0.0%	0.2%
Polypedilum sp.	5	1.6%	10	3.3%	2.5%
Micropsectra sp.	0	0.0%	1	0.3%	0.2%
Rheotanytarsus sp.	13	4.3%	17	5.6%	4.9%
Dicranota sp.	0	0.0%	1	0.3%	0.2%
Hemerodromia sp.	1	0.3%	0	0.0%	0.2%
Simulium spp.	14	4.6%	32	10.5%	7.5%
EPHEMEROPTERA					
Baetis tricaudatus	5	1.6%	0	0.0%	0.8%
Diphetor hageni	9	3.0%	18	5.9%	4.4%
Centroptilum ?	0	0.0%	5	1.6%	0.8%
Paraleptophlebia sp.	1	0.3%	2	0.7%	0.5%
TRICHOPTERA					
Ceratopsyche spp.	5	1.6%	7	2.3%	2.0%
Cheumatopsyche spp.	109	35.7%	123	40.2%	38.0%
LEPIDOPTERA					
Petrophila sp.	8	2.6%	10	3.3%	2.9%
ODONATA					
Ophiogompus sp.	0	0.0%	1	0.3%	0.2%
ANNELIDA					
Erpobdellidae	0	0.0%	1	0.3%	0.2%
Lumbricidae	1	0.3%	0	0.0%	0.2%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
East Spring Creek - below Farriers Dam - Aug 31, 1994
Id's by D McGuire

sample:	4.1		4.2		Cum
Taxon	#	% RA		% RA	% RA
CRUSTACEA					
Decapoda	1	0.3%	0	0.0%	0.2%
Caecidotea sp.	41	13.4%	50	16.3%	14.9%
Hyalella azteca	49	16.1%	7	2.3%	9.2%
% of sample used:	20%		25%		Mean
TOTAL ORGANISMS	305		306		306
TAXA RICHNESS	22		20		21.0
EPT RICHNESS	5		5		5.0
BIOTIC INDEX	6.09		5.67		5.88
% DOMINANT TAXON	36%		40%		38%
% EPT	42%		51%		46%
% COLLECTORS (g+f)	95%		95%		95%
% SCRAPERS + SHREDDERS	3%		3%		3%
% Hydropsychinae of TRICH	100%		100%		100%
METALS TOLERANCE INDEX	4.53		4.37		4.45
% Baetidae of EPHEM.	93%		92%		93%
SHANNON DIVERSITY	3.12		2.99		3.05
EPT/(EPT + Chironomidae)	0.72		0.82		0.77
HBI- CTQa	103		102		103
% COLEOPTERA	4%		5%		4%
% DIPTERA	21%		22%		22%
% CHIRONOMIDAE	16%		11%		14%
% EPHEMEROPTERA	5%		8%		7%
% PLECOPTERA	#REF!		#REF!		#REF!
% TRICHOPTERA	37%		42%		40%
% multivoltine	25%		29%		27%
% univoltine	74%		70%		72%
% semivoltine	0%		0%		0%
FFG	% RA	# taxa	% RA	# taxa	%RA
% FILTERERS	46%		58%		52%
% COLLECTOR-GATHERERS	49%		36%		42%
% SHREDDERS	0%		0%		0%
% SCRAPERS	3%		3%		3%
% PREDATORS	2%		2%		2%
Scraper/(Scraper+Filterer)	5%		5%		5%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Trumbull Creek - nr mouth - Aug 31, 1994
Id's by D McGuire

sample:	3.1		3.2		Cum
Taxon	#	% RA		% RA	% RA
COLEOPTERA					
Cleptelmis ornata	73	27.8%	69	22.8%	25.1%
Narpus concolor	0	0.0%	1	0.3%	0.2%
Optioservus spp.	40	15.2%	50	16.5%	15.9%
Brychius sp.	0	0.0%	2	0.7%	0.4%
DIPTERA					
Thienemannimyia gp.	1	0.4%	0	0.0%	0.2%
Pagastia sp.	20	7.6%	11	3.6%	5.5%
Cricotopus sp.	2	0.8%	4	1.3%	1.1%
Eukiefferiella spp.	1	0.4%	3	1.0%	0.7%
Orthocladius sp.	0	0.0%	1	0.3%	0.2%
Parametriocnemus sp.	3	1.1%	1	0.3%	0.7%
Rheocricotopus sp.	7	2.7%	6	2.0%	2.3%
Tvetenia sp.	1	0.4%	10	3.3%	1.9%
Micropsectra sp.	1	0.4%	2	0.7%	0.5%
Dicranota sp.	1	0.4%	0	0.0%	0.2%
Pericoma sp.	1	0.4%	0	0.0%	0.2%
Limnophora sp.	0	0.0%	2	0.7%	0.4%
Stratiomyiidae	1	0.4%	0	0.0%	0.2%
Simulium spp. (Psilozoa)	21	8.0%	49	16.2%	12.4%
EPHEMEROPTERA					
Baetis tricaudatus	18	6.8%	25	8.3%	7.6%
Diphetor hageni	10	3.8%	16	5.3%	4.6%
Tricorythodes sp.	0	0.0%	1	0.3%	0.2%
TRICHOPTERA					
Parapsyche sp.	2	0.8%	3	1.0%	0.9%
Hydroptila sp.	2	0.8%	0	0.0%	0.4%
Lepidostoma sp.	0	0.0%	1	0.3%	0.2%
Brachycentrus occidentalis	5	1.9%	0	0.0%	0.9%
ANNELIDA					
Lumbricidae	4	1.5%	0	0.0%	0.7%
Tubificidae	1	0.4%	0	0.0%	0.2%
MOLLUSCA					
Lymnaeidae	7	2.7%	5	1.7%	2.1%
Physidae	8	3.0%	8	2.6%	2.8%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Trumbull Creek - nr mouth - Aug 31, 1994
Id's by D McGuire

sample:	3.1		3.2		Cum
Taxon	#	% RA		% RA	% RA
CRUSTACEA					
Gammarus sp.	0	0.0%	1	0.3%	0.2%
Caecidotea sp.	12	4.6%	4	1.3%	2.8%
OTHER					
Turbellaria	21	8.0%	28	9.2%	8.7%
% of sample used:	17%		13%		Mean
TOTAL ORGANISMS	263		303		283
TAXA RICHNESS	25		24		24.5
EPT RICHNESS	5		5		5.0
BIOTIC INDEX	4.67		4.91		4.79
% DOMINANT TAXON	28%		23%		25%
% EPT	14%		15%		15%
% COLLECTORS (g+f)	86%		84%		85%
% SCRAPERS + SHREDDERS	6%		6%		6%
% Hydropsychinae of TRICH	0%		0%		0%
METALS TOLERANCE INDEX	4.74		4.84		4.79
% Baetidae of EPHEM.	100%		98%		99%
SHANNON DIVERSITY	3.55		3.47		3.51
EPT/(EPT + Chironomidae)	0.51		0.55		0.53
HBI- CTQa	99		100		100
% COLEOPTERA	43%		40%		42%
% DIPTERA	23%		29%		26%
% CHIRONOMIDAE	14%		13%		13%
% EPHEMEROPTERA	11%		14%		12%
% PLECOPTERA	0%		0%		0%
% TRICHOPTERA	3%		1%		2%
% multivoltine	41%		52%		47%
% univoltine	58%		47%		52%
% semivoltine	1%		1%		1%
FFG	% RA	# taxa	% RA	# taxa	%RA
% FILTERERS	11%		17%		14%
% COLLECTOR-GATHERERS	75%		67%		71%
% SHREDDERS	0%		2%		1%
% SCRAPERS	6%		4%		5%
% PREDATORS	9%		10%		9%
Scraper/(Scraper+Filterer)	35%		20%		27%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamp
East Spring Creek - @ HWY 35 - Aug 1991 &1992
Id's by Bluestem

sample:	1991.1		1991.2		1992. (1+2)	
Taxon	#	% RA	#	% RA		% RA
COLEOPTERA						
Optioservus spp.	20	9.2%	5	2.3%	38	16.8%
Zaitzevia parvula	16	7.3%	0	0.0%	7	3.1%
Brychius sp.	7	3.2%	4	1.8%	36	15.9%
DIPTERA						
Pagastia sp.	23	10.6%	33	15.1%	67	29.6%
Eukiefferiella spp.	15	6.9%	3	1.4%	2	0.9%
Orthocladius sp.	0	0.0%	5	2.3%	0	0.0%
Parametriocnemus sp.	0	0.0%	4	1.8%	0	0.0%
Rheocricotopus sp.	0	0.0%	2	0.9%	0	0.0%
Tvetenia sp.	0	0.0%	10	4.6%	0	0.0%
Microtendipes sp.	0	0.0%	0	0.0%	1	0.4%
Micropsectra sp.	2	0.9%	6	2.8%	17	7.5%
Dicranota sp.	0	0.0%	1	0.5%	0	0.0%
Hexatoma sp.	1	0.5%	0	0.0%	1	0.4%
Limnophora sp.	0	0.0%	3	1.4%	0	0.0%
Empididae	0	0.0%	0	0.0%	2	0.9%
Stratiomyiidae	0	0.0%	0	0.0%	1	0.4%
Simulium spp.	103	47.2%	135	61.9%	13	5.8%
EPHEMEROPTERA						
Baetis tricaudatus	10	4.6%	4	1.8%	12	5.3%
Heptageniidae	0	0.0%	0	0.0%	1	0.4%
TRICHOPTERA						
Cheumatopsyche spp.	1	0.5%	0	0.0%	0	0.0%
Glossosoma sp.	1	0.5%	1	0.5%	6	2.7%
ODONATA						
Ophiogompus sp.	0	0.0%	0	0.0%	13	5.8%
ANNELIDA						
Lumbricidae	1	0.5%	0	0.0%	1	0.4%
MOLLUSCA						
Lymnaeidae	0	0.0%	1	0.5%	1	0.4%
Planorbidae	1	0.5%	0	0.0%	0	0.0%
Physidae	0	0.0%	0	0.0%	6	2.7%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamp
East Spring Creek - @ HWY 35 - Aug 1991 &1992
Id's by Bluestem

sample:	1991.1		1991.2		1992. (1+2)	
Taxon	#	% RA	#	% RA		% RA
CRUSTACEA						
Caecidotea sp.	0	0.0%	0	0.0%	1	0.4%
Hyalella azteca	0	0.0%	1	0.5%	0	0.0%
OTHER						
Turbellaria	4	1.8%	0	0.0%	0	0.0%
TOTAL ORGANISMS	205		218		226	
TAXA RICHNESS	15		16		19	
EPT RICHNESS	4		2		3	
BIOTIC INDEX	5.17		5.17		4.00	
% DOMINANT TAXON	50%		62%		30%	
% EPT	6%		2%		8%	
% COLLECTORS (g+f)	93%		95%		71%	
% SCRAPERS + SHREDDERS	4%		3%		22%	
% Hydropsychinae of TRICH	50%		0%		0%	
METALS TOLERANCE INDEX	5.96		6.10		5.62	
% Baetidae of EPHEM.	100%		100%		92%	
SHANNON DIVERSITY	2.52		2.13		3.15	
EPT/(EPT + Chironomidae)	0.25		0.07		0.18	
HBI- CTQa	103		105		94	
% COLEOPTERA	21%		4%		36%	
% DIPTERA	70%		93%		46%	
% CHIRONOMIDAE	19%		29%		38%	
% EPHEMEROPTERA	5%		2%		6%	
% PLECOPTERA	0%		0%		0%	
% TRICHOPTERA	1%		0%		3%	
% multivoltine	77%		93%		50%	
% univoltine	23%		7%		45%	
% semivoltine	0%		0%		6%	
FFG	% RA	# taxa	% RA	# taxa	% RA	# taxa
% FILTERERS	50%		62%		6%	
% COLLECTOR-GATHERERS	43%		33%		65%	
% SHREDDERS	3%		2%		16%	
% SCRAPERS	1%		1%		6%	
% PREDATORS	2%		2%		7%	
Scraper/(Scraper+Filterer)	2%		1%		52%	

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
East Spring Creek - @ Granite View - Aug, 1991 &1992
Id's by Bluestem

sample:	1991		1992		Cum
Taxon	#	% RA		% RA	% RA
COLEOPTERA					
Optioservus spp.	12	4.3%	35	11.7%	8.1%
Zaitzevia parvula	0	0.0%	13	4.3%	2.3%
Brychius sp.	6	2.2%	2	0.7%	1.4%
DIPTERA					
Pagastia sp.	75	27.0%	99	33.1%	30.2%
Eukiefferiella spp.	4	1.4%	0	0.0%	0.7%
Orthocladius sp.	33	11.9%	15	5.0%	8.3%
Tvetenia sp.	1	0.4%	0	0.0%	0.2%
Micropsectra sp.	4	1.4%	13	4.3%	2.9%
Dicranota sp.	2	0.7%	4	1.3%	1.0%
Limnophora sp.	1	0.4%	0	0.0%	0.2%
Empididae	0	0.0%	1	0.3%	0.2%
Stratiomyiidae	1	0.4%	1	0.3%	0.3%
Simulium spp.	111	39.9%	13	4.3%	21.5%
EPHEMEROPTERA					
Baetis tricaudatus	5	1.8%	52	17.4%	9.9%
Baetis bicaudatus	0	0.0%	1	0.3%	0.2%
Heptageniidae	0	0.0%	1	0.3%	0.2%
TRICHOPTERA					
Hydropsyche spp.	1	0.4%	7	2.3%	1.4%
Ceratopsyche spp.	0	0.0%	2	0.7%	0.3%
Cheumatopsyche spp.	15	5.4%	12	4.0%	4.7%
Parapsyche sp.	0	0.0%	1	0.3%	0.2%
Brachycentrus occidentalis	3	1.1%	7	2.3%	1.7%
LEPIDOPTERA					
Petrophila sp.	0	0.0%	0	0.0%	0.0%
ODONATA					
Ophiogompus sp.	0	0.0%	0	0.0%	0.0%
ANNELIDA					
Lumbricidae	3	1.1%	1	0.3%	0.7%
MOLLUSCA					
Lymnaeidae	0	0.0%	4	1.3%	0.7%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
East Spring Creek - @ Granite View - Aug, 1991 &1992
Id's by Bluestem

sample:	1991		1992		Cum
Taxon	#	% RA		% RA	% RA
CRUSTACEA					
Caecidotea sp.	0	0.0%	9	3.0%	1.6%
OTHER					
Turbellaria	1	0.4%	6	2.0%	1.2%
% of sample used:					Mean
TOTAL ORGANISMS	278		299		289
TAXA RICHNESS	17		22		19.5
EPT RICHNESS	4		8		6.0
BIOTIC INDEX	4.67		3.80		4.24
% DOMINANT TAXON	40%		33%		37%
% EPT	9%		28%		18%
% COLLECTORS (g+f)	96%		94%		95%
% SCRAPERS + SHREDDERS	2%		2%		2%
% Hydropsychinae of TRICH	84%		72%		78%
METALS TOLERANCE INDEX	6.40		5.95		6.18
% Baetidae of EPHEM.	100%		98%		99%
SHANNON DIVERSITY	2.56		3.27		2.92
EPT/(EPT + Chironomidae)	0.17		0.40		0.28
HBI- CTQa	105		97		101
% COLEOPTERA	6%		17%		12%
% DIPTERA	83%		49%		66%
% CHIRONOMIDAE	42%		42%		42%
% EPHEMEROPTERA	2%		18%		10%
% PLECOPTERA	#REF!		#REF!		#REF!
% TRICHOPTERA	7%		10%		8%
% multivoltine	84%		67%		75%
% univoltine	16%		33%		24%
% semivoltine	0%		0%		0%
FFG	% RA	# taxa	% RA	# taxa	%RA
% FILTERERS	47%		14%		30%
% COLLECTOR-GATHERERS	50%		80%		65%
% SHREDDERS	2%		1%		1%
% SCRAPERS	0%		2%		1%
% PREDATORS	1%		4%		3%
Scraper/(Scraper+Filterer)	0%		11%		5%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
East Spring Creek - Farriers - Aug 1991 &1992
Id's by BlueStem

sample:	1991		1992	
Taxon	#	% RA		% RA
COLEOPTERA				
Optioservus spp.	9	3.1%	7	2.4%
Zaitzevia parvula	0	0.0%	3	1.0%
Dytiscidae	0	0.0%	2	0.7%
DIPTERA				
Thienemannimyia gp.	1	0.3%	4	1.4%
Pagastia sp.	0	0.0%	1	0.3%
Tvetenia sp.	3	1.0%	0	0.0%
Polypedilum sp.	0	0.0%	30	10.1%
Xenochironomus sp.	0	0.0%	2	0.7%
Micropsectra sp.	0	0.0%	1	0.3%
Rheotanytarsus sp.	1	0.3%	0	0.0%
Dicranota sp.	0	0.0%	2	0.7%
Simulium spp.	29	10.1%	21	7.1%
EPHEMEROPTERA				
Baetis tricaudatus	5	1.7%	16	5.4%
Paraleptophlebia sp.	0	0.0%	2	0.7%
TRICHOPTERA				
Hydropsyche spp.	3	1.0%	3	1.0%
Ceratopsyche spp.	8	2.8%	5	1.7%
Cheumatopsyche spp.	169	58.9%	175	59.1%
Helicopsyche sp.	0	0.0%	6	2.0%
LEPIDOPTERA				
Petrophila sp.	0	0.0%	0	0.0%
ODONATA				
Ophiogompus sp.	1	0.3%	3	1.0%
ANNELIDA				
Lumbricidae	0	0.0%	2	0.7%
MOLLUSCA				
Planorbiidae	1	0.3%	1	0.3%
Physidae	1	0.3%	0	0.0%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
East Spring Creek - Farriers - Aug 1991 &1992
Id's by BlueStem

sample:	1991		1992	
Taxon	#	% RA		% RA
CRUSTACEA				
Gammarus sp.	0	0.0%	3	1.0%
Caecidotea sp.	44	15.3%	3	1.0%
Hyalella azteca	12	4.2%	4	1.4%
TOTAL ORGANISMS	287		296	
TAXA RICHNESS	14		22	
EPT RICHNESS	4		6	
BIOTIC INDEX	5.69		5.06	
% DOMINANT TAXON	59%		59%	
% EPT	64%		70%	
% COLLECTORS (g+f)	99%		92%	
% SCRAPERS + SHREDDERS	1%		3%	
% Hydropsychinae of TRICH	100%		97%	
METALS TOLERANCE INDEX	4.97		4.74	
% Baetidae of EPHEM.	100%		89%	
SHANNON DIVERSITY	2.07		2.45	
EPT/(EPT + Chironomidae)	0.97		0.84	
HBI- CTQa	107		102	
% COLEOPTERA	3%		4%	
% DIPTERA	12%		21%	
% CHIRONOMIDAE	2%		13%	
% EPHEMEROPTERA	2%		6%	
% PLECOPTERA	0%		0%	
% TRICHOPTERA	63%		64%	
% multivoltine	14%		25%	
% univoltine	86%		74%	
% semivoltine	0%		1%	
FFG	% RA	# taxa	% RA	# taxa
% FILTERERS	73%		69%	
% COLLECTOR-GATHERERS	25%		23%	
% SHREDDERS	0%		1%	
% SCRAPERS	1%		2%	
% PREDATORS	1%		4%	
Scraper/(Scraper+Filterer)	1%		3%	

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Trumbull Creek - Aug 1991
Id's by Bluestem

sample:	1.1		1.2		Cum
Taxon	#	% RA		% RA	% RA
COLEOPTERA					
Cleptelmis ornata	0	0.0%	2	0.9%	0.4%
Optioservus spp.	16	6.3%	24	10.3%	8.2%
Zaitzevia parvula	16	6.3%	57	24.6%	15.0%
Brychius sp.	7	2.7%	4	1.7%	2.3%
DIPTERA					
Pagastia sp.	54	21.2%	16	6.9%	14.4%
Eukiefferiella spp.	0	0.0%	1	0.4%	0.2%
Orthocladius sp.	20	7.8%	8	3.4%	5.7%
Parametriocnemus sp.	77	30.2%	33	14.2%	22.6%
Tvetenia sp.	0	0.0%	45	19.4%	9.2%
Cryptochironomus sp.	0	0.0%	1	0.4%	0.2%
Micropsectra sp.	29	11.4%	2	0.9%	6.4%
Limnophora sp.	5	2.0%	1	0.4%	1.2%
Simulium spp.	12	4.7%	15	6.5%	5.5%
EPHEMEROPTERA					
Baetis tricaudatus	3	1.2%	3	1.3%	1.2%
Timpanoga hecuba	1	0.4%	3	1.3%	0.8%
Tricorythodes sp.	1	0.4%	2	0.9%	0.6%
TRICHOPTERA					
Ceratopsyche spp.	2	0.8%	0	0.0%	0.4%
Cheumatopsyche spp.	0	0.0%	1	0.4%	0.2%
Brachycentrus occidentalis	1	0.4%	1	0.4%	0.4%
ANNELIDA					
Lumbricidae	1	0.4%	5	2.2%	1.2%
MOLLUSCA					
Lymnaeidae	2	0.8%	1	0.4%	0.6%
Physidae	5	2.0%	3	1.3%	1.6%
CRUSTACEA					
Gammarus sp.	2	0.8%	1	0.4%	0.6%
Caecidotea sp.	1	0.4%	3	1.3%	0.8%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Trumbull Creek - Aug 1991
Id's by Bluestem

sample:	1.1		1.2		Cum
Taxon	#	% RA		% RA	% RA
TOTAL ORGANISMS	255		232		244
TAXA RICHNESS	19		23		21.0
EPT RICHNESS	5		5		5.0
BIOTIC INDEX	4.36		4.64		4.50
% DOMINANT TAXON	30%		25%		27%
% EPT	3%		4%		4%
% COLLECTORS (g+f)	92%		96%		94%
% SCRAPERS + SHREDDERS	6%		4%		5%
% Hydropsychinae of TRICH	67%		50%		58%
METALS TOLERANCE INDEX	4.96		4.31		4.63
% Baetidae of EPHEM.	60%		38%		49%
SHANNON DIVERSITY	3.11		3.34		3.23
EPT/(EPT + Chironomidae)	0.04		0.09		0.06
HBI- CTQa	105		104		104
% COLEOPTERA	15%		38%		26%
% DIPTERA	77%		53%		65%
% CHIRONOMIDAE	71%		46%		58%
% EPHEMEROPTERA	2%		3%		3%
% PLECOPTERA	#REF!		#REF!		#REF!
% TRICHOPTERA	1%		1%		1%
% multivoltine	77%		54%		66%
% univoltine	23%		46%		34%
% semivoltine	0%		0%		0%
FFG	% RA	# taxa	% RA	# taxa	%RA
% FILTERERS	6%		7%		7%
% COLLECTOR-GATHERERS	86%		88%		87%
% SHREDDERS	4%		2%		3%
% SCRAPERS	3%		2%		2%
% PREDATORS	2%		0%		1%
Scraper/(Scraper+Filterer)	32%		19%		25%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Trumbull Creek - Aug 1992
Id's by Bluestem

sample:	1		2		Cum
Taxon	#	% RA		% RA	% RA
COLEOPTERA					
Lara avara	0	0.0%	2	0.7%	0.3%
Optioservus spp.	34	11.6%	33	11.3%	11.4%
Zaitzevia parvula	44	15.0%	101	34.5%	24.7%
Brychius sp.	0	0.0%	3	1.0%	0.5%
DIPTERA					
Pagastia sp.	23	7.8%	7	2.4%	5.1%
Cricotopus sp.	8	2.7%	2	0.7%	1.7%
Orthocladius sp.	47	16.0%	37	12.6%	14.3%
Parametriocnemus sp.	49	16.7%	21	7.2%	11.9%
Tvetenia sp.	18	6.1%	12	4.1%	5.1%
Micropsectra sp.	12	4.1%	2	0.7%	2.4%
Antocha sp.	1	0.3%	0	0.0%	0.2%
Dicranota sp.	2	0.7%	3	1.0%	0.9%
Limnophora sp.	1	0.3%	0	0.0%	0.2%
Stratiomyiidae	0	0.0%	7	2.4%	1.2%
Simulium spp.	5	1.7%	9	3.1%	2.4%
EPHEMEROPTERA					
Baetis tricaudatus	20	6.8%	28	9.6%	8.2%
Baetis bicaudatus	0	0.0%	1	0.3%	0.2%
Tricorythodes sp.	0	0.0%	2	0.7%	0.3%
TRICHOPTERA					
Ceratopsyche spp.	4	1.4%	0	0.0%	0.7%
Arctopsyche sp.	0	0.0%	0	0.0%	0.0%
Parapsyche sp.	3	1.0%	1	0.3%	0.7%
Hydroptila sp.	0	0.0%	1	0.3%	0.2%
Brachycentrus occidentalis	7	2.4%	1	0.3%	1.4%
ANNELIDA					
Lumbricidae	1	0.3%	3	1.0%	0.7%
MOLLUSCA					
Lymnaeidae	3	1.0%	1	0.3%	0.7%
Physidae	5	1.7%	5	1.7%	1.7%
Sphaeriidae	0	0.0%	1	0.3%	0.2%

AQUATIC MACROINVERTEBRATE DATA-RBP kick samples (~300 organism subsamples)
Trumbull Creek - Aug 1992
Id's by Bluestem

sample:	1		2		Cum
Taxon	#	% RA		% RA	% RA
CRUSTACEA					
Caecidotea sp.	5	1.7%	10	3.4%	2.6%
OTHER					
Turbellaria	1	0.3%	0	0.0%	0.2%

% of sample used:					Mean
TOTAL ORGANISMS	293		293		293
TAXA RICHNESS	21		24		22.5
EPT RICHNESS	4		6		5.0
BIOTIC INDEX	4.70		4.77		4.74
% DOMINANT TAXON	17%		34%		26%
% EPT	12%		12%		12%
% COLLECTORS (g+f)	96%		95%		96%
% SCRAPERS + SHREDDERS	3%		4%		3%
% Hydropsychinae of TRICH	29%		0%		14%
METALS TOLERANCE INDEX	4.60		4.16		4.38
% Baetidae of EPHEM.	100%		94%		97%
SHANNON DIVERSITY	3.57		3.29		3.43
EPT/(EPT + Chironomidae)	0.18		0.30		0.24
HBI- CTQa	101		101		101
% COLEOPTERA	27%		47%		37%
% DIPTERA	57%		34%		45%
% CHIRONOMIDAE	54%		28%		41%
% EPHEMEROPTERA	7%		11%		9%
% PLECOPTERA	#REF!		#REF!		#REF!
% TRICHOPTERA	5%		1%		3%
% multivoltine	62%		42%		52%
% univoltine	37%		58%		47%
% semivoltine	1%		0%		1%

FFG	% RA	# taxa	% RA	# taxa	%RA
% FILTERERS	6%		4%		5%
% COLLECTOR-GATHERERS	89%		91%		90%
% SHREDDERS	0%		2%		1%
% SCRAPERS	3%		2%		2%
% PREDATORS	1%		1%		1%
Scraper/(Scraper+Filterer)	30%		33%		31%